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**A CONCEPTUAL FRAMEWORK FOR
EVALUATING FOREIGN INVESTMENTS**

BY

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I. INTRODUCTION

Like domestic capital investment decisions, international capital budgeting focuses upon expected incremental cash flows associated with a project. The specification of these flows for the international project creates the usual difficulties found in a domestic capital project, but international project analysis is more complex. Although the basic pattern follows the same model as that suggested by corporate financial theory, the multinational firm must consider factors peculiar to international operations.

A project may be estimated to produce very considerable cash flows in a foreign territory but, because of exchange control restrictions, the bulk of these foreign cash flows may not be distributable to the parent company. In these circumstances, looking at the project purely in terms of cash flows accruing in the foreign territory may indicate that it is worth investing. But is this good enough? Surely the present value to the parent company is a function of future cash flows accruing to it which are distributable to the parent company's investors. If the bulk of foreign territory cash flows were blocked by exchange controls, it would only be incremental cash flows which are remittable back to the parent company which add value for its investors. International capital projects may be looked at from at least two standpoints • incremental project cash flows and incremental parent cash flows. To the international company it is only incremental parent cash flows that can add shareholder value.

Unfortunately, the published literature on international capital budgeting has failed to develop a logical and complete model for specifying net present value for cross-frontier investments. Whilst various texts attempt to use case studies to identify

net present value in international projects, none presents a conceptual framework. This paper is intended to fill this lacuna.

In this paper, we focus upon the theory of value creation through international investment. This starts with a summary of some of the complications that international, as opposed to domestic, investment creates in terms of financial appraisal. In turn, this flows into a normative framework for international capital budgeting both under circumstances without exchange controls and where such imperfections are in place.

There is a handful of complexities in international capital budgeting. These embrace situations where:

- there are knock-on effects from one country to another. For example, investment in a subsidiary in country X affects cash flows of a subsidiary in country Y,
- project cash flows and parent cash flows differ,
- part of the parent input is via equipment,
- exchange rates are not expected to be constant throughout the project's life,
- different rates of tax apply in the country of the project and in the parent's country,
- royalties and management fees are involved,
- full remittance of cash flows arising from a project are restricted in terms of payment to the parent.

In international capital budgeting, a significant difference usually exists between the cash flow of a project and the amount that is remittable to the parent. The main reason for this may be the existence of exchange controls in the host nation. Management in an overseas subsidiary can be excused for focusing only upon project cash flows accruing locally. Overseas managers often ignore the consequences of an investment upon the rest of the corporation - in particular the impact of the project at

the level of distributable cash flows of the parent company. At the level of the project itself, the appropriate incremental cash inflows are those additional cash outturns resulting from new operations after adjustment for local corporate taxes. From the parent's view, the critical incremental cash flow figures are the additional remittable funds to the parent treasury in London or New York or Amsterdam or wherever. From the central treasury's point of view, the important cash flows relating to a new investment are incremental cash flows that are distributable to the multinational's headquarters.

In practice, surveys - see Stonehill and Nathanson (1968), Oblak and Helm (1980), Bavishi (1981), Wicks Kelly and Philippatos (1982), Stanley and Block (1983), Kim Farragher and Crick (1984), Shao and Shao (1993) and Buckley, Buckley, Langevin and Tse (forthcoming) - have shown that firms give distributable parent cash flows far too little weight in evaluating international investments. Most surveys indicate that leading multinationals focus upon income measures other than distributable parent cash flows as often as homing in on remittable parent cash flow. Furthermore, they indicate an amazing lack of sophistication - between 10 and 20 per cent of large US multinationals are reported as using accounting rate of return as their primary evaluation technique. Estimates of the use of payback as a first-choice decision criterion are variously reported as high in frequency as 28 per cent. The regular use of these basic techniques as primary evaluation screens is far away from what normative theory would suggest. Indeed, Stonehill and Nathanson (1968) made the observation that 'a better conceptual framework for evaluating foreign investments is needed'. Although their quotation goes back almost thirty years, the empirical literature on corporate evaluation of international investment shows that their comment is probably as relevant now as it was then.

II. TAXATION

It will be noted that the approach advocated here involves investment appraisal from the parent standpoint, with profit flows arising in the host territory first of all falling

into the local tax net. Then, on distribution (or assumed distribution), they may be subjected to a withholding tax and, finally, in the home territory they may fall into the tax net again.

The application of host and home taxation in terms of arriving at cash generation in home country currency is the harshest tax treatment. But does it best take account of the real world of the multinational? To answer the question, consider an example. Imagine a multinational based in the USA but with no home operations - all of its businesses are overseas. Suppose that dividends to group shareholders and amounts to cover head office costs are paid out of dividends remitted from the European subsidiaries. Assume further that the group has interests in the Far East, Australasia and Africa. These are profitable but pay no dividend to the headquarters in the USA. Surely, given such a scenario, it would be illogical to apply home and host tax to new investments in Europe only, but debit Far Eastern, Australasian and African projects with host country taxation only - in other words to allow them to avoid home tax for evaluation purposes.

If the illogicality is not immediately apparent, we could take as an example an otherwise similar group except that this second multinational pays for group dividend and head office costs out of profit remittances from the Far East, Australasia and Africa - in other words, the European subsidiaries would remit no dividends in this instance. Clearly, it would not be sensible for the first multinational to give investments in the Far East, Australasia and Africa a free ride as far as US tax is concerned and for the latter to exempt European project proposals from US tax.

We have come across evidence of more than one multinational charging all of its overseas projects (for investment appraisal purposes) with a hypothetical average home tax rate based on evening out the above anomaly. But perhaps the best approach is to look at overseas projects with the harshest tax treatment for the base case and run sensitivity analysis assuming zero home tax and with an average group

tax rate. This should give group directors the wherewithal to exercise informed judgement, which is what investment appraisal is surely designed to do.

Before we turn to the analysis of international capital budgeting decisions where there are no exchange controls in force, we briefly focus upon real operating options, a topic of frequent importance in international investment but one that is given inadequate coverage in the literature.

III. REAL OPERATING OPTIONS

In the usual discounted cash flow calculations, the perspective that is so often taken is a static one, static in the sense that operating decisions are viewed as being fixed in advance. As such, they give rise to the base case set of incremental cash flows. But, for many projects, there is a complexity which renders the traditional discounting methodology less than wholly appropriate. This is concerned with operational flexibility. Structuring investments - and other managerial actions too - in a manner that maintains flexibility, rather like options, adds value to the firm. Investments of this kind should be evaluated to embrace these option characteristics and analyzed from a standpoint beyond the traditional DCF model. Failure to evaluate investments with option characteristics - and that probably means two thirds of all capital commitments - to allow for this aspect can only result in an understatement of potential shareholder value created.

A call option in the stock market gives the holder the right to buy shares at a fixed price over a period of time but not the obligation to do so. Similarly an investment in research and development gives the firm the potential to acquire the benefits thereof for the cost of commercialization. The owner of a mine or oil well has the possibility of acquiring the proceeds from the mine's or oil well's output but does not have an obligation to do so and, like the stock market call option buyer, he or she may defer selling the proceeds of the asset's output. Pre-emptive (and not necessarily heavy) investment in new markets, whether domestic or international, may give the firm the

edge when it comes to opportunities for scaling up to a full sized production and distribution network whilst retaining the option to withdraw from that market if outturns are unfavourable. With respect to research and development, minerals extraction projects and exploratory investments in new markets, including international ones, classic DCF techniques, unless accompanied by serious modification, fail to take into account the tactical flexibility and value-creating upside potential of subsequent add-on aspects and consequently understate true investment potential.

Various articles have appeared stressing the need to extend the analysis of certain kinds of investment decisions to embrace these option-type characteristics. Reference to the put option aspect of capital investment - the value of the potential to abandon the project - has a long history. Robichek and van Horne (1967) were among the first to recognise this feature. The option to expand further - the call option - has been the focus of a number of general papers, Kester (1984 and 1986) and Mason and Merton (1985) having pioneered the way. Brennan and Schwartz (1985a and b) and Siegel, Smith and Paddock (1987) apply the option pricing model to mining and oil exploration projects respectively as do Dentskevich and Salkin (1991). Kasanen (1986) focused upon R and D endowing options and Copeland, Koller and Murrin (1994) note its relevance to minerals industries and pharmaceutical research and development. Sahlman (1988) identifies real option aspects in venture capital financing. Morck, Schwartz and Strangeland (1989) apply the theory to forestry resources, Titman (1985) and Quigg (1993) both see its relevance in urban land valuation and Damodaran (1994) refers to real options in valuing patents. Hendricks (1991) even applies the ideas to environmental pollution and global warming.

So far only a few have applied the notion to international investment. For example, de Meza and van der Ploeg (1987), Sercu and Uppal (1994) and Bell (1995) focus upon the production flexibility of the international firm to switch sourcing following shocks - changed labour costs or exchange rates - in economies in which the multinational operates. Others, such as Folks and Aggarwal (1988), Shapiro (1992), Kester and Morley (1992), Buckley (1994 and 1996), Kogut and Kulatilaka (1994) and

Sercu and Uppal (1995) highlight growth options which may accrue following international investment. And Baldwin (1987) and Kulatilaka and Marcus (1992) refer to it in passing - their respective foci being with financing and embedded options in operational flexibility.

Both Myers (1984) and Barwise, Marsh and Wensley (1989) refer to the failure of traditional project evaluation to take cognizance of the value of growth options as a source of tension between finance and strategic management. The message is that the old-style capital appraisal techniques are more than adequate in terms of dealing with pure cash saving investments but leave something to be desired where there is operational flexibility or contingent opportunities for growth. In these circumstances, DCF methods consistently undervalue projects due to their failure to allow for strategic flexibility. At the current time it is fair to say that far too few standard textbooks on financial management give this topic sufficient coverage. Notable exceptions include Franks, Broyles and Carleton (1985), Copeland and Weston (1988), Shapiro (1990), Brealey and Myers (1991), Weston and Copeland (1992) and Ross, Westerfield and Jaffe (1996) - although whether these volumes' slim coverage of such an important topic is adequate must be decidedly debatable. When the topic is incorporated, it is frequently referred to by the letters PVGO - present value of growth opportunities.

Growth options are by no means always associated with international investment, although cross-frontier expansion may be one of the most fertile sources of such possibilities. They are likely to be born of market imperfections or, to use some of the phrases used in Dunning's (1977, 1988) eclectic theory of international production, to be associated with competitive advantages of the multinational in the areas of firm-specific advantages, location-specific advantages or internalization advantages. By and large, they reside in three areas - these are:

- situations where the new project may, later on, be scaled-up

- situations where a new project in a foreign country may make easier the marketing of the firm's existing, home market product line to overseas customers
- situations where multinationality gives increased operational flexibility, for example increasing output from one location to capitalize on an exchange rate movement or lower relative labour costs,

Our view is that the present value of growth options in international investment decisions is far too important to ignore.

Before moving the discussion on, we also note that Dixit and Pindyck (1994), in their development of a set of option-based strategies, point out that 'the ability to delay an irreversible investment expenditure can profoundly affect the decision to invest. It also undermines the simple net present value rule, and hence the theoretical foundation of standard neoclassical investment models'. They go on to conclude that 'as a result the NPV rule must be modified'. We return to this point in the context of international investment appraisal in Section VI below.

IV. PROJECT EVALUATION WITH NO EXCHANGE CONTROLS

Whether a project is subject to exchange controls or not, the initial appraisal invariably begins with an analysis in host country currency terms. Such an appraisal generally involves the basic cash flow techniques of domestic capital budgeting incorporating the computation of a net present value or internal rate of return. The methodology might incorporate calculations with discount rates reflecting required returns in local currency terms. Clearly this would indicate how a local partner might view a particular project. But it would not be this perspective from which the multinational should evaluate a foreign capital investment decision. To the international corporation, the relevant focus is upon remittable cash flows. In terms of adding value, it does not matter whether the flows are actually remitted, the fact that there is no impediment to remittance should, logically, create value for the corporation.

Thus, it is assumed that all available incremental free cash flow (normally profit before interest and tax, add back depreciation, less fixed capital inputs, less working capital inputs, less tax payable) is paid out and remitted to the multinational headquarters. The parent will, for project evaluation purposes, convert to home currency at the anticipated exchange rate and also allow for notional home territory corporate tax.

In the analysis which follows, we approach the problem of international project evaluation without exchange controls on the assumption that the parent company owns all of the equity in the foreign subsidiary. This assumption is relaxed later on. Although Shapiro (1978) points out that 'incremental cash flows to the parent can be found by subtracting world-wide parent company cash flows (without the investment) from post-investment parent company cash flows', the more usual approach is to home in from the very beginning upon incremental cash flows to the parent, focusing substantially upon the project rather than the entire company. This latter method usually involves less computation, but where there are knock-on effects, great care has to be exercised. By this is meant those kind of situations where, for example, investment in a new plant in Spain affects output and cash generation in, say, the French and Belgian subsidiaries. This kind of situation is encompassed by the third bullet point in the next paragraph. Of course, whether the route to incremental cash flows is via world-wide remittable cash flows or through remittable cash generation at the level of the project itself, the final decision should be the same.

Where a multinational company contemplates an overseas investment on the basis of 100 per cent ownership, as is frequently the case, and when there are no exchange controls, the present value calculation, from the parent's viewpoint, should include:

- the multinational's incremental free cash flow year by year (net of host and home tax)
- royalties, management fees and the like, if any (net of home tax)

- any cannibalization effects must be allowed for in the evaluation. For example, if the multinational were exporting direct to the host country prior to implementation of the project and subsequently it is to be locally sourced the loss of contribution, net of tax, must be built into the calculation.
- if there is any subsidized interest involved, the present value of the subsidy must be incorporated. For example, use of purchased US equipment by a European based multinational, undertaking investment in the Far East, may attract a lower than market interest rate for dollars based on Exim Bank finance. The subsidy, net of tax, should be discounted year by year at the market rate for dollar finance, net of tax, to arrive at a present value. Of course, where such subsidized finance is available in a foreign currency, the question of covering the exposure must be considered and appropriate action taken.
- where part of the parent's contribution to the overseas project is via equipment input, this must be allowed for. If the equipment input is without actual cost passing, but would otherwise be used within the parents ongoing business, Buckley (1992) sets out an appropriate basis of valuation. If the circumstances are as above, except that cash is paid, the consideration, net of any tax effects, must be incorporated.
- the multinational's opportunity to exploit any real operating options. As to how any such options might be valued is considered in later sections of this paper.
- if incremental free cash flows are forecast over a finite time period only, the question of a terminal value has to be addressed. Various approaches to calculating this are considered later.

Table 1 provides a summary of generally encountered incremental cash flows as sources of value in international capital budgeting without exchange controls. It refers to the two most frequently used routes to specifying value - the net present value (NPV) and adjusted present value (APV) methods. With the former, the appropriate

discount rate is the risk-adjusted weighted average cost. With the latter, it is the risk-adjusted all-equity cost of capital. But, in the APV case, it is further necessary to include an amount representing the value of the tax shield on debt sustainable by the project under consideration. We now turn to how the various sources of value can be specified algebraically.

TABLE 1
SUMMARY OF RELEVANT INCREMENTAL CASH FLOWS • INTERNATIONAL
INVESTMENT WITH NO EXCHANGE CONTROLS

	Approach used	
	NPV	APV
Value of investment inputs	✓	✓
Value of incremental free cash flow of overseas investment	✓	✓
Value of management fees and royalties	✓	✓
Value of any cannibalization effects to the group	✓	✓
Value of any subsidized interest involved	✓	✓
Value of any real operating options	✓	✓
Allowance for terminal values	✓	✓
Value of tax shield due to debt; the amount will vary from classical to imputation tax system		✓

The value of investment inputs embraces fixed capital and working capital required to undertake the project. This might be thought of as a gross amount C , in local currency terms as at year of the project. In our initial scenario there are no minority interests, but we should nonetheless, focus upon the present value of this amount, C , converted to home currency at the time zero exchange rate, e_0 , less any allowances for parent equipment input. This point is worth focusing upon for a while.

Suppose that the foreign investment requires 1000 of equipment. Assume that 200 of this comes from the parent but only has a worth of 150. Clearly the net input is 950. The virtue of doing calculations in terms of a cost of 1000 less the profit on transfer is that the whole amount of 1000 may attract tax depreciation in the host country and the equipment transferred may attract a capital gains tax charge in the country of the parent. These factors are better tracked, in appraisal terms, if calculation is done on the basis of an input of 1000 (as a separate item) less the profit on equipment transferred of 50 (again as a separate item).

So, the amount of investment input to be included in the appraisal might be written as:

$$C e_0 - (T_f - T_h - t_g)$$

where T_t is the transfer value, where T is the opportunity cost value and t_g represents any capital gains tax implications • all of these three values should be in home currency terms.

The next item in Table 1 is the value of incremental free cash flows. In home currency terms, this should be given by:

$$\sum_{t=0}^n \frac{FCF_t (1 - t_w) e_t (1 - t_c)}{(1 + k)^t}$$

where FCF_t is the host country free cash flow for the investment (after local corporate tax, of course, and after parent management fees and royalties) in year t , where t_w represents the host country withholding tax rate, where t_c represents the rate of additional corporate tax payable in the home country on distribution, e_t is the exchange rate in year t and k is the appropriate discount rate.

Of course, if free cash flow is forecast for a finite period only, it will be necessary to incorporate a terminal value • see Table 1. Where the valuation of free cash flow is based on forecasting to infinity, this would not be necessary.

Table 1 next specifies the value of management fees and royalties. Assuming that the home currency total of such amounts in year t is given by R_t which is stated net of host country withholding taxes and home currency corporate taxes, the present value of a finite stream of management fees and royalties may be written as:

$$\sum_{t=0}^n \frac{R_t}{(1 + k)^t}$$

Note that it was suggested that FCF, above would be calculated net of management fees and royalties. On this basis, double counting is avoided.

Again, assessing forecasts for a finite period, it would logically follow ~~that~~ a terminal value of royalties and management fees should be incorporated in the valuation exercise. Where the forecast is done on a simplified assumption of being to infinity, this would not be necessary. The same kind of idea also applies in respect of cannibalization effects, the next of our valuation parts in Table 1.

In international capital budgeting, it is often the case that a new investment may have knock-on effects. For example, a new plant in a host country may mean lost exports to the host country from elsewhere in the group, or it may mean a new scheduling of production and sales with the new facility taking output from elsewhere in the group. The contribution on such lost turnover should be allowed for in the capital budgeting proposal if accurate simulation of reality is to be achieved. If M_t represents the lost margin, net of taxes, in home currency in year t from such knock-on effects, the present value of this impact may be represented by:

$$\sum_{t=0}^n \frac{M_t}{(1+k)^t}$$

Of course, for an integrated group of companies, there may be positive upstream and/or downstream effects, the contribution from which should be included in the analysis.

Referring back to Table 1, we next look at subsidized interest. As mentioned earlier, this frequently arises as a result of equipment purchase involving the equivalent of the Exim Bank in the country of supply. So, the subsidy may be in a currency other than that of host or parent, in which case forward cover or swapping has to be considered. For example, a Dutch parent company considering investment in Malaysia but purchasing Japanese equipment may find that it can access yen at below the market rate. The amount of the interest subsidy would be given by the annual interest payment in yen versus the market rate annual interest payment in yen - less costs of forward cover assuming the company wishes to avoid foreign exchange risk on such

interest payments. Usually such subsidized finance is only available for relatively short periods, say m years. Assuming that i_t is the amount of the subsidy in year t , r is the market rate of interest for the foreign currency concerned, and E is the forward exchange rate for year t to convert the exposure to the required currency (probably, although not necessarily, either host or home currency), the present value of subsidized interest is given by:

$$\sum_{t=0}^m \frac{i_t E_t}{(1 + r)^t}$$

Note that the discount rate used is r which is the market rate for the currency in which the subsidy is denominated. This contrasts with earlier value calculations where the discount rate k was the appropriate rate representing either a risk-adjusted weighted average cost of capital for the project concerned or the ungeared cost of equity dependent upon whether the calculation is based upon NPV or APV methods respectively.

A different approach is adopted in this case because we would normally discount at a rate reflecting the riskiness of the cash flow stream concerned. To apply the rate k to our interest rate stream is not an acceptable practice. The riskiness of the interest-related stream of cash flows should be taken into account by discounting at the market interest rate - and this is clearly much different from k . If this is accepted, the next question concerns whether r should be pre-tax or post-tax. In capital budgeting exercises we are always concerned with post-tax incremental cash generation so it follows that the logical discount rate should be an after tax one. Since we are concerned with home country value creation, the relevant tax rate to apply to both the interest subsidy and to the discount rate would logically be the home country corporate tax rate. Note that this tax rate should be applied to both numerator and denominator to ensure consistency.

If we revert to Table 1, it will be noted that our next source of value creation is real operating options. Since this topic is a moderately complicated one, we return to

it in the next section of this paper. Its importance in international investment cannot be stressed too much, hence the justification of separate treatment. Suffice to say, for now, that the host currency present value of such real operating options associated with a new investment proposal has to be incorporated with the value of growth options which may accrue elsewhere in the group to give a total value which needs to be incorporated into our calculations.

According to the order of considering topics in Table 1, terminal value comes next. When we forecast incremental cash generation for a project out to year n and this is a finite period, we may or may not expect the project to cease then. If we do expect it to cease, we should get back the value of invested working capital and something for fixed capital too. This must be allowed for as a terminal value.

If we do not expect the project to cease but are merely truncating it at some finite number of years for analysis purposes, then we should allow for a terminal value to take account of operations beyond the conveniently assumed truncation date. In such cases the terminal value should embrace the value of:

- free cash flows from the investment converted to home currency and net of host, withholding and home taxes
- royalty and management fees, net of all taxes
- cannibalization effects beyond the truncation date, net of all taxes

Whilst the former is usually allowed for in calculations, the latter two are frequently forgotten in international investment appraisal.

Whether the firm calculates value in project appraisal via net present value or adjusted present value presents further complications. Essentially, the use of the NPV criterion logically presupposes that incremental operating cash flows should be discounted at k_0 , the weighted average cost of capital suitably adjusted for systematic project risk and allowing for the debt level sustainable by the project. By contrast, the

APV approach uses an all-equity discount rate, k^* , with the value of the tax shield on debt sustainable by the project calculated separately. Lessard (1981) prefers to use the APV method in evaluating overseas projects, on grounds of transparency and simplicity. This claim of simplicity is challenged by Booth (1982) because, correctly implemented, the APV technique requires the maintenance of a constant debt/equity ratio and the modelling of this involves a procedure which would hardly be considered simple.

The suggested methodology for estimating the value of an international investment to the multinational corporation in a situation where there are no exchange controls has so far been approached on the assumption that the project does not have minority interests. Where there are minorities in the overseas investment, the valuation process needs to be changed marginally, since the minorities will participate in some cash flow streams, but not all. Note that, normally, of the cash flows categories listed in Table 1, the minority partners will participate pro-rata in :

- value of incremental free cash flows of the overseas investment
- value of subsidized interest
- value of real operating options accruing in the host country

The minority might not share pro-rata in the investment inputs. Remember that the parent may sell, or transfer for value, equipment to the overseas venture: clearly such effects have to be allowed for in investment appraisal from the home-based parent company's standpoint. Management fees, royalties and cannibalization effects also have to be allowed for but these are invariably exclusively for the parent - the minority does not participate in such effects at all. Similarly, when it comes to calculating a terminal value and this is based on future free cash flows of the project, future royalties and future cannibalization effects, clearly the minority interests would only be participants in the first of these values - and adjustment needs to be made appropriately.

V. VALUING REAL OPTIONS

As mentioned earlier, the present value of growth options in international investment is too important to ignore. Estimating their magnitude using a Black and Scholes (1973) routine is appropriate where all of the conditions of their model are met.

Growth options essentially involve an outlay of money, a kind of pioneering investment, which, if successful, leads on to scaling up later on which, in turn, may again lead on to further scaling up. Growth options of this kind would effectively constitute compound options.

A compound option is an option on an option. There are four main types of compound options: a call on a call, a put on a call, a call on a put, and a put on a put. Normally they have two strike prices and two exercise dates. Let us look for example at a call on a call. On the first exercise date, T_1 , the holder of the compound option is entitled to pay the first strike price, X_1 , and to receive a call option. This call option gives the holder the right but not the obligation, to buy the underlying asset for the second strike price, X_2 , on the second exercise date, T_2 . The compound option would logically only be exercised on the first exercise date if the value of the option on that date is greater than the first strike price.

European-style compound options, assuming the usual geometric Brownian motion, may be valued, according to Geske (1979), in terms of integrals of the bivariate normal distribution. The value at time zero of a European call option on a call option is given by:

$$S e^{-q T_2} M(a_1, b_1; \sqrt{T_1/T_2}) - X_2 e^{-r T_2} M(a_2, b_2; \sqrt{T_1/T_2}) - e^{-r T_1} X_1 N(a_2)$$

where

$$a_1 = \frac{\ln(S/S^*) + (r - q + \sigma^2/2)T_1}{\sigma\sqrt{T_1}}, \quad a_2 = a_1 - \sigma\sqrt{T_1}$$

$$b_1 = \frac{\ln(S/X_1) + (r - q + \sigma^2/2)T_2}{\sigma\sqrt{T_2}}, \quad b_2 = b_1 - \sigma\sqrt{T_2}$$

The function $N(\cdot)$ is the univariate normal distribution function. The function M is the cumulative bivariate normal distribution function with a and b as upper and lower integral limits and correction coefficient $\sqrt{T_1/T_2}$. S is the current share price and S^* is the share price at time T , for which the option price at time T , equals X . The term q represents the continuous dividend yield on the share, r represents the continuously compounded riskless rate of interest, e is the base of the natural logarithm (2.71828) and σ^2 is the variance of the continuously compounded rate of return on the share. If the actual share price is above S^* at time T , the first option will be exercised; if it is not above S^* , the option will expire worthless.

Real world compound options are not too far away from these ideas. In fact in the world of the oil industry, Kemna (1993) reports the application by Shell of the Geske (1979) model for valuing compound options. The example cited by Kemna involved a multi-stage project phased as to construction of the pioneer venture followed, a number of years later, by start-up of production of the pioneer venture. A few years later would be the decision time to start the commercial venture and, if sanctioned, necessary scale-up and start-up of the commercial venture would follow. Kemna points out that 'in option pricing terms, 'buying' the pioneer venture would give management the right to acquire a commercial venture by paying its investment outlay. This option will only be exercised if the commercial venture is profitable at the maturity date of the option. Investing in the pioneer venture today is thus similar to investing in a growth option. In a sense, the negative NPV of the pioneer venture is part of the cost of buying this growth option. The investment problem can therefore be restated as follows: does the

value of the growth option justify the cost of buying this option?' In her article, Kemna goes on to develop an appropriate valuation model using the Geske methodology,

Whilst estimates of compound option values, using the above method, flow from situations where volatilities can be estimated and the Brownian motion assumption applies, it is not always clear that this would be the case for international investment. Certainly it could be argued that these requirements would hold for raw materials and commodities but the bulk of international investment is not necessarily of this type. By contrast, it invariably involves transplanting a market imperfection which has successfully created value in one geographical market to another. Given the underpinning of significant market imperfections in many cross-border investments, it may be argued that they would promise a distribution of potential outturns which would be anything but normal. Such a function would render the application of methodologies based wholly upon Black and Scholes less than appropriate. Jarrow and Rudd (1982) and Hull (1993) eloquently point out, amongst others, the pitfalls of using models which assume lognormality in situations where the world is different. The very idea that businessmen attempt to create market imperfections in real operations would seem to reduce the likelihood of lognormal returns, thus rendering the use of Black and Scholes-type formulae less than fully suitable. Furthermore, the Black and Scholes assumption of constant volatility and interest rates, whilst not a great problem in valuing financial options of short maturities, seems inappropriate in looking at investments of relatively long horizon. Others would argue that one of the key reasons for options pricing formulae failing to capture the reality of markets, other than commodity markets, is the presence of market imperfections which create sufficient bias in returns and patterns of outturns as to render the application of formulae like Black and Scholes less than apposite.

This is reinforced by the fact that in stockmarkets, commodity markets and foreign exchange markets, option prices at a point in time are determined by the intrinsic value based on the underlying share price, commodity price or exchange rate adjusted to allow for time value. Given that share prices, commodity prices and

exchange rates are objectively determined by markets, we commence from a situation where future prices can be expected to follow a random walk. For a new concrete roof tile plant in Hungary, it is doubtful whether an objective value is apparent. Indeed, for an international project concerned with outputs of other than commodities (for example, oil), there is no objective value from which to move forward. This makes it extremely unlikely that future returns will follow a random walk.

However, we do not have to throw the baby out with the bathwater. Where the assumptions of the Black and Scholes model are breached, we do have a perfectly feasible alternative route to putting values on real options. It involves a decision tree approach and it has widespread application in the literature of option valuation - see, for example, Cox, Ross and Rubinstein (1979), Boyle (1988) and Hull and White (1988).

Fully to model potential outturns, the real operating options analysis might incorporate a view which results in a lattice framework of the kind frequently found in explanations of option pricing theory in financial text books. Computer modelling becomes necessary as the lattice becomes complex and an extended time span of analysis becomes lengthy.

In text books, lattice frameworks frequently incorporate a binomial symmetry - generally for illustrative purposes only. Far more likely is a decision tree with non-symmetrical features to allow, for example, for product relaunches or changed tactics should poor results ensue. It is the probability of this lack of symmetry which is one of the key aspects of the contention that a Black and Scholes methodology, for valuing the real operating option, is less than appropriate. Certainly, in commodity markets prices are likely to follow a random walk about a most likely price but in markets where imperfections are present biased returns would be expected.

In practical terms, this kind of framework for analysis now enables us to build in scale-up options in appropriate places and develop the lattice accordingly. The

objective of the exercise must never be let out of sight and that is that one is concerned with valuing real operating options. The fact that the analysis will, in all probability, have to be explained to the top management decision coalition should mean that the exercise is kept within reasonably comprehensible bounds.

Although slightly more complicated, Kulatilaka (1995) gives an example which begins by specifying, what he calls, a naive NPV (our base case NPV) and then incorporates the value of the abandonment option, growth option and a timing option value (which we prefer to take account of independently - see Section VI below). Whilst Kulatilaka uses a Black and Scholes based valuation model, his paper could easily be adapted to calculate values via a decision tree route.

The message should be apparent. A strategy that adds corporate value is to maintain flexibility through structuring investments in a manner paralleling options. Investments of this kind, which includes most international commitments, should be analyzed beyond the traditional DCF model. This means evaluating them to embrace the option characteristic. Structuring investment decisions in such a way as to confer an option element enhances shareholder value over and above the base case present value scenario. Failure to evaluate investments of this kind to allow for this option aspect may, at best, result in an understatement of the potential shareholder value created and may, at worst, mean that firms fail to undertake growth strategies and ultimately pack their product portfolios with yesterday's winners but today's dogs.

VI. TIMING

Another area that we will briefly focus upon is one which requires incorporation into our calculations if optimal international capital commitments are to be achieved. We refer to the question of timing of investment. Earlier, we quoted Dixit and Pindyck (1994) and their observation that 'the ability to delay an irreversible investment expenditure can profoundly affect the decision to invest. In particular, it invalidates the simple net present value rule as it is commonly taught'. They go on to point out that

this simple rule is less than complete 'because it ignores the opportunity of making a commitment now, and thereby giving up the option of waiting for new information'. Note that Dixit and Pindyck's recommendation is specifically worded to apply to irreversible expenditures. An expenditure would be classified as reversible if its net present value could readily be recouped by resale. An example might be industrial land in a thriving city where sites are in short supply.

To implement their prescription, we would have to calculate the net present value of planned investment beginning now inclusive of real operating option values as suggested heretofore in this paper. We would then compare it with the value of leaving the option to invest unexercised and also to set it in the context of the value of waiting for further information and investing next year or the year after or the year after that.

Fully to model the implications of timing would mean the calculation of true investment values assuming commitment at different times. If investment proposals are not accompanied by calculations of this kind, board directors should be asking questions about timing of investment commitments. The point about timing is just as relevant for projects with exchange controls as for those without - indeed the idea here applies to all projects, whether domestic or international.

VII. PROJECT EVALUATION WITH EXCHANGE CONTROLS

Rather like project analysis where no exchange controls are operative, investment appraisal with controls normally begins by focusing upon the host country currency cash flows. This would be the perspective from which a local partner would appraise the investment - but it would not be the angle that the multinational would find most relevant. Again, as in the case where no exchange controls were assumed to exist, the focus of the international group would be upon remittable cash generation. And, of course, the existence of exchange controls create a significant barrier to such remittability.

When exchange controls exist, it is very frequently the case that investment is undertaken in conjunction with a local partner - sometimes this is a legal requirement in the host country, sometimes it is of the multinational managers' own volition. Given this tendency, the analysis here assumes the involvement of a local partner.

Where a multinational firm contemplates an overseas investment and where there are exchange controls impacting upon potential remittances to the parent, then the present value calculation, from the parent company's standpoint, would include:

- the multinational's investment input. There are complications here since such subscription may be via equity or parent debt. Subscribing by the debt route may allow cash generated by the project to be returned to the home country by debt repayment and interest whereas, were subscription to be via equity, such flows might be blocked by controls.
- remittances of cash generated back to the parent, primarily, through dividend payment. Of course, not all cash generated would be remittable because of exchange control constraints. Thus, forecasts of annual profit and loss accounts and balance sheets - not just cash generation details - will be critical to the evaluation since, when exchange controls exist, remittance is invariably based upon a proportion of profit or some formula related to profit in conjunction with capital employed (or capital originally subscribed from outside the host country plus retained earnings).
- remittances back to the parent by way of parent debt service - capital plus interest - and management fees and royalties, although these are invariably subject to very careful scrutiny and to ceilings set by exchange control authorities and regulations.
- allowance for investment from local debt raised as part of the initial financing. Against this, one should logically include debt repayment and interest thereon. The virtue of an analysis which embraces investment financed by third party debt and its service is that it ensures that all capital required is accounted for in the project appraisal. Some analysts,

by contrast, leave these items out of the analysis all together. If the project generates sufficient blocked cash flows to repay debt and accrued interest, this latter approach is entirely acceptable (it will, incidentally, achieve the same bottom line result as the approach recommended). If this is not the case, then the more conservative approach is to reduce the dividends assumed to be distributed to take account of the repayment schedule.

- as in the earlier example, where no relevant exchange control were in existence, cannibalization effects must be built into the equation.
- when we are confronted with exchange controls on an overseas project and where finance with a subsidized interest rate is raised by the overseas venture, we do not need to take account of any subsidized interest as a separate item in the cash flow analysis - as was the case where no exchange controls were present. Remember that when there were no exchange controls, we would undertake our cash flow appraisal by applying a discount rate to cash generation before interest. So the worth of the interest subsidy must be calculated separately. By contrast, where exchange controls are present, the bottom line of the forecast profit and loss account will already have taken into account interest charges - including the effect of the subsidy itself. However, when host country exchange controls are present but the multinational raises soft debt, specifically and unequivocally tied to the project, in a company outside of the host country, then the case for including the value of the subsidy as a parent cash flow is clear. Indeed, the multinational may structure the financing deal to ensure that it receives the full benefit of the subsidized interest itself.
- allowances, as in the case where there are no exchange controls, for parent contribution of equipment as part of its input. The cash flow analysis, of course, may well have different values for the equipment compared with the local balance sheet figure for initial input,
- any real operating option effects.

- invariably, in international capital budgeting with exchange controls, blocked cash flows remain after allowing for dividend distribution (whether expected or notional) and debt service. There are a number of approaches to valuing these. But, first of all, let it be said that if such cash were permanently blocked with no means available to get cash back to the parent then the value of such blocked funds must be zero. In reality, this is rarely the case. First, counter-trade and such techniques present ways of unblocking. And second, there is usually some expectation of existing controls being relaxed or removed altogether. A probability factor may be applied to model such expectations. Care has to be taken to avoid double counting: we refer to this later on in this section.
- an allowance for any terminal values.

Table 2 provides a summary of the generally encountered sources of value in international investment appraisal with exchange controls. We now examine the items in the table in more detail and in turn.

TABLE 2
SUMMARY OF RELEVANT INCREMENTAL CASH FLOWS •
INTERNATIONAL INVESTMENT WITH EXCHANGE CONTROLS

	Approach used	
	NPV	APV
Share of equity inputs allowing for subscription via equipment etc.	✓	✓
Share of input as parent debt	✓	✓
Share of input as local debt*	✓	✓
Value of remittable dividend stream	✓	✓
Value of management fees and royalties	✓	✓
Value of cannibalization effects to the group	✓	✓
Value of any subsidized interest involved only if it is raised and serviced outside of the host country and, presumably, in a territory without exchange controls	✓	✓
Repayment of parent debt and interest thereon	✓	✓
Repayment of local debt and interest thereon*	✓	✓
Value of any real operating options	✓	✓
Share of blocked cash flows allowing for:	✓	✓
- countertrade remittability, or		
▪ multiplying by factor for discontinuance of exchange controls		
Allowance for terminal value	✓	
Value of tax shield due to debt; the amount will vary from classical to imputation tax system		

* Some analysts exclude both of these two items ▪ see text for an overview and commentary on this problem.

The value of the parent's share of investment inputs may cover fixed and working capital required to undertake the project. If we think of the home currency value of the amount subscribed in cash and equipment as C , of which input in kind is valued, as in the earlier section on project evaluation with exchange controls, at T_f , then where T is the appropriate opportunity cost value of such inputs and by t_g represents any capital gains tax implications, the amount of investment input from the parent for investment appraisal purposes would be given by:

$$C = (T_f - T - t_g)$$

All of the above items would logically be valued in home currency terms and the split between equity and debt input would be a question of the particular contractual agreements between parent and overseas operating business.

The next item in Table 2 concerns locally raised debt. There are two approaches available with respect to this item. First of all, we might leave this out of the analysis entirely and we might compensate for this by disregarding local debt service. This is entirely acceptable as long as it is remembered that there may be cash effects in terms of reduction in assumed dividend where insufficient cash is generated to service debt and dividend in an individual year. Thus, for evaluation purposes, payment of dividend may be constrained by shortages of cash in particular years. The alternative approach is to include investment financed by local debt and, to compensate, to allow for debt service in the cash flow analysis. This latter approach ensures that full ramifications, in cash flow terms, are kept track of and this may be valuable when it comes to undertaking sensitivity analysis with lower than expected outturns.

The next item is the value of the parent's share of remittable dividend stream. This can be expressed as:

$$\sum_{t=0}^n \frac{D_t (1 - t_w) e_t (1 - t_c)}{(1 + k)^t}$$

where D_t is the parents share of dividend in year t , where t_w represents the rate of host country withholding tax and t_c represents the rate of additional corporation tax payable in the home country on distribution, e_t is the exchange rate in year t and k is the appropriate discount rate.

Of course, in order to determine the estimated level of remittable dividend to the parent, forecast profit and loss accounts and balance sheets for the overseas venture will have to be prepared. Any dividend remittance will only be payable out of the

balance on profit and loss account after taking off such items as royalties and interest payments.

The value of management fees and royalties is, in fact, the next item which Table 2 specifies. Assuming that the home currency total of such amount in year t is given by R_t which is stated net of host country withholding taxes and net of home currency taxes too, the present value of a finite stream of management fees and royalties may be written as:

$$\sum_{t=0}^n \frac{R_t}{(1+k)^t}$$

As we mentioned earlier in this paper, cannibalization effects in international capital budgeting have to be taken into account. If M_t represents the lost margin, net of taxes, in home currency terms in year t , from knock-on effects, the present value of this impact would amount to:

$$\sum_{t=0}^n \frac{M_t}{(1+k)^t}$$

Next we turn to subsidized interest. Note that Table 2 states that its value would only, logically, be included if it were raised and serviced outside of the host country's exchange controls • indeed, presumably, in a country without exchange controls thus enabling the multinational to acquire the full value of the subsidy. The whole point here is that if the debt is raised in the host country, by the operating company there, its financial effects will already be felt in profit and loss account terms before determining dividends remittable. By contrast, if raised outside of the host country, the subsidy will not have been built in to the equation. Essentially, the earlier remarks under the sixth bullet point at the start of this section should make the point clear. If such subsidized funding is outside of the host territory, its value should be determined in exactly the

same manner as suggested in the section relating to project evaluation without exchange controls on subsidized debt.

When we refer back to Table 2, we see that the next items are parent and local loan repayments and interest. Clearly, the inclusion of local debt service will be a function of whether or not it has been allowed for in the initial cost of the investment. (This was discussed earlier in this section). There is no such problem with parent debt -this should unequivocally be included in our cash flow analysis. The objective of the multinational putting in some of its subscription as parent debt is to enable payments to the parent to occur in the presence of host country exchange controls. Of course, host governments respond by restricting debt levels, for exchange control purposes, through thin capitalization rules, which allow the host to refer to notional leverage levels for parent debt service purposes. Aside from such problems, the cash flow implications for the parent in the home country are clear. Capital and interest would normally be denominated in home currency terms. This would ensure that debt service was in parent currency terms and would result in relatively straight forward cash flow implications from the parent's standpoint.

The next item to be referred to in Table 2 relates to real operating options. Calculations on this front should accord with the methodology suggested in Section V on valuing real operating options • but it should be noted that, where there is a local partner, the effect will be to share the value of such options which are within the host territory operating company.

We next turn to the value of blocked cash flows. As we stated earlier, if blocked for ever, with no possibility of unblocking, the value of such cash to the parent can only, logically, be zero. Usually, in the real world, there are possibilities of unblocking based on:

- such devices as countertrade
- the probability of the host country relaxing exchange controls

Both of the above bullet points mean that we might put a value on blocked cash which is 'unblockable'. For capital budgeting purposes, this might involve estimating the amount of blocked cash to be built each year, taking the multinational's share, allowing for counter-trade costs and then estimating the net of tax value in parent currency terms. The present value might amount to:

$$\sum_{t=0}^n \frac{B_t (1-u) e_t (1-t_c)}{(1+k)^t}$$

where B_t represents blocked cash potentially built up in host currency terms as a result of operational and financial actions in year t , u represents an estimated percentage for countertrade costs, e_t is the exchange rate in year t , the item t_c represents the tax rate to be applied to funds so remitted. Of course, k again represents the appropriate discount rate.

Another approach, in terms of valuing blocked cash flows, is to assume that they build up within the company in the host country, earning appropriate interest up to some terminal value date and then to apply a probability factor to take account of potential unblocking as of that date. Mathematically, the present value might then be expressed as :

$$\left\{ \sum_{t=0}^n B_t (1+i)^{n-t} \right\} \frac{p e_n (1-t_c)}{(1+k)^n}$$

where B_t is the blocked cash throw-off in year t , i represents the local currency interest rate earned on blocked cash, n represents the horizon terminal value year, p is the probability of unblocking in year n , e_n represents the anticipated exchange rate in year n , t_c represents the additional tax rate applicable to any such flow repatriated and k represents the appropriate discount rate.

Of course, it should be mentioned that these ideas apply also to the value of real operating options. A portion of the value of the multinational's share might be blocked

and must be valued in a manner approximately consistent with the approach suggested immediately above.

In Table 2, terminal value comes next. When we focus upon cash flows up to year n , a finite period, we might or might not expect cash flows to cease then. If we do expect them to cease, we should get back a share of invested capital in terms of working capital released, any residual values of fixed capital and any blocked cash. Clearly the multinational's share of this represents a terminal value in the project although care may have to be exercised to ensure that no double-counting of blocked cash occurs and it is also necessary to allow for the impact of controls to be in place at the end of the project's life.

If it is not expected that the project will cease but it is merely being truncated after a finite period for ease of analysis, then a terminal value should be allowed for on the basis of expected operations and their cash flow implications beyond the assumed truncation date. In such a case, the terminal value should embrace the value of:

- dividend flows in home currency terms net of all taxes
- blocked cash generation beyond the truncation date capitalized as suggested above. This might include, of course, blocked real operating options
- a royalties and management fees net of all taxes
- cannibalization effects beyond the truncation period net of all taxes

Of course, it is assumed that all loans (especially to the parent) have been repaid by the truncation date; if not, then appropriate amounts with their specific timing should be duly taken into account.

Finally, in terms of items listed in Table 2, there is the question of whether the NPV or APV criterion is being used to estimate value. Where the APV route is adopted, the appropriate tax shield calculations must be made - the coverage given

to this topic towards the end of the section on project evaluation with no exchange controls applies equally in the case of international investment appraisal with exchange controlling.

VIII. CONCLUSIONS

In analyzing international capital budgeting propositions, it is necessary to distinguish two very different kinds of situation. The first of these is where there are no exchange controls in the host country. The second is where there is partial blockage of overseas cash generation. Distinguishing which category a particular project falls into is necessary because the recommended methodology of analysis varies from one to the other. In this paper, we have developed deductive models to appraise international investment projects. This fills a gap in the existing literature which has failed heretofore to present a clear model for investment appraisal in cross-border situations. In developing our models, we have taken account of real operating options, and the timing problem.

Finally, we would append two other relevant sets of ideas. First, debt-equity swaps are becoming popular with corporations as a means of reducing the cost of investment in less developed countries. Debt-equity swaps are financial transactions in which LDCs exchange part of their debt with foreign commercial banks for equity rights which are sold to an interested party. Debt-equity swaps can be a profitable source of advantage for firms that exploit their key benefit - access to local currency at exchange rates more favourable than the official rate.

Clearly, from the standpoint of the corporate investor, entry into a developing country via the debt-equity swap market is achieved at a cost lower than would otherwise be the case. In capital budgeting terms, then, the initial capital cost is lowered. From the point of view of the Third World country, debt is redeemed and increased investment is encouraged. Obviously this topic is one which is particularly relevant in the case of international capital budgeting with exchange controls since

most of the LDCs with the potential for undertaking attractive debt-equity swaps are nations with significant exchange controls.

Second, the usual capital budgeting considerations as regards beginning the analysis with a best estimate picture of cash flows and then adjusting outturns to allow for the effects of a number of 'what-if?' scenarios would apply. In addition to the usual changes to market share, lower demand, late commissioning of plant and so on, one might allow for variations from the harshest tax treatment, using different exchange rates, estimating terminal values using different methodologies, and assessing the sensitivity of outturns to varying levels of political risk and to varying assumptions about real operating options.

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